

zygoma, the measurement being taken along a line drawn vertically to the zygoma from the stephanion. The stephanion is the point where the temporal ridge crosses the coronal suture, both of which can be readily made out by steadily pressing the scalp with the thumb over their supposed sites. If the coronal suture cannot be felt, there can be felt a rounded ridge bounded by two grooves, and the suture lies in this ridge. The highest point of the squamoparietal suture is under the temporal muscle in a vertical line drawn in front of the articulation of the lower jaw, being at the point at about the junction of the upper and middle thirds of the distance between the ridge of the temporal muscle and the upper border of the zygoma. The anterior branch of the fissure of Sylvius runs upward and forward from the pterion, continuing, as it were, the line of the sphenoido-squamous suture, but commencing one or two millimetres in front of it. The precentral sulcus runs parallel to and just behind the coronal suture, and reaches to about the centre of the fissure of Rolando; from it diverges the inferior frontal sulcus about opposite to the superior temporal ridge. The superior frontal sulcus commences in the ascending frontal convolution about midway between the fissure of Rolando and a line continued upward in the line of the precentral sulcus. The interparietal sulcus, which forms the posterior boundary of the motor area, can be located after the position of the fissures of Sylvius and Rolando are known; for it begins opposite the knee-like bend in the fissure of Rolando, and turns backward just below the horizontal level of the superior frontal sulcus. Here it lies midway between the fissure of Rolando and the centre of the parietal eminence. Further up, as it passes backward, it lies midway between the longitudinal fissure and the centre of the parietal eminence. The parieto-occipital fissure lies just in front of the lambdoid suture. Having found the fissures and sulci, the situation of the convolutions can be readily determined. M. A. S.

PHYSIOLOGY (INCLUDING PHYSIOLOGICAL PSYCHOLOGY).

The Time Taken up by Cerebral Operations. (*Mind*, April, July, and October, 1886.)

Dr. J. M. Cattell, in the psychological laboratory at Leipsic (Wundt's), has made a re-determination of the reaction-time for various mental processes, and claims to have used improved methods of recording, and to have eliminated errors that have formerly been made in making out the averages. The times were recorded by a Hipp chronoscope, which was controlled by an instrument devised by Cattell and called the gravity-chronoscope, by means of which the error (sometimes amounting to one-tenth sec.) due to the time consumed in magnetizing and demagnetizing the electro-magnet of the Hipp instrument is eliminated. For obtaining the correct average, he has used a different method from that used by Exner, Merkel, and others. A reaction may vary so from the average that the whole series will have a false value. Exner

simply ignored reactions that seemed too long or too short, but Cattell criticises this by saying that the experimenter thinks he has found the proper worth, and then almost unconsciously leaves out of his reckoning the reactions which would invalidate it.

C. has taken a series of 13 or 26 reactions, calculated the average, and the variation of each reaction from the average. Then he has dropped the reaction having the largest variation; the average of the 12 or 24 reactions remaining has been calculated anew, and the reactions varying most from this average again dropped. In this way the 3 or 6 worst reactions have been dropped, and the 10 or 20 best reactions remain with the variations of each of these from the average. In tabulating the results, .001 sec. has been taken as a unit, and he uses the symbol σ to represent this unit, analogous to $\mu = .001$ mm.

The following table is a summary of the results for the two observers, Berger and Cattell.

	B.	C.
Reaction-time for light.....	150	150
Perception-time for light.....	30	50
" " a color.....	90	100
" " a picture.....	100	100
" " a letter.....	120	120
" " a (short) word.....	120	130
Will-time for colors.....	280	400
" " pictures.....	250	280
" " letters.....	140	170
" " words.....	100	110

No explanation of the reaction-time is necessary, as this means the same to all observers, but an analysis of what C. considers to make up the perception-time and will-time is of interest. He defines the perception-time as the interval between sensation and perception (or between indefinite and definite perception), the time passing after the impression has reached consciousness before it is distinguished. Wundt obtained his results by letting the subject react as quickly as possible in one series of experiments, and in a second series not to react until he had distinguished the impression, the difference of the time in the two series giving the perception-time for the impression. Cattell was not able to get results by this method. Donders, von Kries, Auerbach, and others thought that if the subject reacts on one of two impressions and makes no motion when the other occurs, only a perception has been added to the simple reaction. C. claims, and with justice, that this is not the case, it being necessary, after the impression has been distinguished, to decide between making a motion and not making it. Cattell assumes that the changes do not penetrate into the cortex at all when a simple reaction is made; but when

lights of two different colors are used (say red and blue), and the subject may only lift his hand if the light is blue, the motor impulse cannot be sent to the hand until the subject knows that the light is blue; the motor impulse must therefore travel to the cortex and excite changes there, causing in consciousness the sensation or perception of a blue light; this gives a perception-time the additional time necessary for a nervous impulse to be prepared and sent to a motor centre, and discharge as a motor impulse gives the will-time. The point is worth emphasizing, and C. does not think it possible to add a perception to the reaction without also adding a will-act, agreeing with Wundt, but differing from Donders, von Kries, and others. C. changes the nature of the perception without altering the will-time, and thereby claims to get, with considerable thoroughness, the length of the perception-time.

C. assumes that the time of the centripetal and centrifugal progress through the brain (or the perception-time and will-time) is about the same, and that the time used in the cortex is about equally divided between the perception of the light and the preparation of the motor impulse, and so by dividing into two parts, the remainder obtained by subtracting the simple reaction-time from the whole time, including both discernment and choice, estimates the perception-time for light, of B. at 0.03 sec., and of himself at 0.050. With regard to these results, we can only say that the matter is still *sub judice*, and that we cannot yet, with confidence, assign to each element of the psycho-physical time its true value.

WILLIAM NOYES.

On the Reaction-Time for Auditory Impressions in Hysterical Subjects in the Different States of Hypnotism and especially in Echolalia. (*Revue Philosophique*, April, 1886.)

In these experiments, reported to the *Société de Psychologie Physiologique*, the subject held a telephone against her ear, and to her chin was attached an apparatus by which an electric current made a record on a Marcy tambour every time she pronounced the word "toc;" the telephone was also in a circuit that made a record on the same cylinder with a Deprez signal; when the electric contact was made it produced at the same time a noise in the telephone and made a signal on the tambour. The hysterical subject said "toc" each time she heard a noise in the telephone, and as quickly as possible, thus giving the reaction time for this patient for auditory impressions. In the *waking state* the reaction-time was thirty-nine hundredths of a second. In the condition of *somnambulism* the reaction-time was not more than thirty-three hundredths of a second. The subject was then placed in a condition in which she exhibited the phenomena of *echolalia*, that is, during *somnambulism* one of the experimenters placed his hand on the top of her head and she repeated faithfully all the sounds that came to her ear. She reproduced the noise made in the tele-

phone by a sound very much like the word "toc." Now in this case the reaction-time was only thirty-one hundredths of a second, or three hundredths less than in the simple somnambulistic state. The results are interesting as showing that in echolalia the will appears to be completely absent, and this interval of three hundredths of a second measures the duration of the voluntary psychic operation which was suppressed by the appearance of the echolalia. The original communication is not given, but it is difficult to see why the *will-time* is not two hundredths of a second rather than three as stated by the reporters MM. Marie and Azoulay.

WILLIAM NOYES.

The Anatomy and Physiology of Touch.

It is just about three years since the study of the dermal sensations was enriched by the epoch-making discovery of separate points for the reception of cold and of warm sensations. The names associated with this discovery are Magnus Blix, of Upsala, Alfred Goldscheider, of Berlin, and H. H. Donaldson of Johns Hopkins University. Dr. Goldscheider has, however, carried the work on in greater detail than any one else, and the papers published within the last year would make quite a respectable volume. He has just added to these an account of the microscopic appearances of sections of skin containing the temperature and other points. (*Archiv für Anatomie und Physiologie*, Supplement, 1886.)

Dr. Goldscheider distinguishes three kinds of points on the skin: cold-points, heat-points, and pressure-points; each of these kinds of points are arranged in chains running in a somewhat curved manner, the chains generally radiating from certain points of the skin. These points of radiation are apt to coincide with the insertion of hairs.¹ The cold- and heat-points cannot arouse pressure or pain sensations, but when stimulated give rise to temperature sensations only. On the pressure-points pressure sensations are aroused and the prick of a needle gives continued pain. On intermediate points pressure and pain are felt in a slight measure. The points do not all react with equal intensity.

Starting with these physiological facts, the problem is to find their anatomical basis. The law of the specific energy of nerves has been justified, *i. e.*, every nerve reacts in one and but one way, no matter how it is excited. The same nerve fibre cannot give rise to both temperature and pressure-sensations, but there must be entirely separate fibres for each. The anatomical proof of this prediction of physiology is a very delicate task. The skin abounds in all sorts of nerve fibres, and to distinguish one kind from another seems almost a hopeless task. It is easy to trace the endings of the optic or the auditory nerves, because no other fibres occur

¹ It should be stated that in his arrangement of the points and in his views on the nature and existence of the pressure-points, Goldscheider differs very much from the other observers.

in their immediate vicinity. The most promising method of differentiating the nerve endings in the skin is to locate typical heat-, cold- and pressure-points exactly, then cut them out from the living human skin and prepare sections for microscopic study. Dr. Donaldson tried this method on himself, but with a negative result. Dr. Goldscheider has refined the method of excision and preparation and offers results which, though not final or complete, are welcome as they are suggestive.

The point to be excised was marked accurately with indelible ink and carefully cut out. In cutting out a heat-point, there was a sudden intense burning sensation; a cold feeling was aroused in cutting out a cold-point; and in excising a pressure-point the pain was much more severe and constant than in the case of temperature-points. This is analogous to the vivid light caused by operations on the optic nerve and shows the universality of the law of specific nerve energy. It also shows the insensibility to pain of the temperature-points; a needle can be run into these without causing pain. As to the microscopic appearances the points of importance are these: (1) In each case nerve fibres are found *directly* under the marked sensitive points, thus showing the anatomical basis of these sensations. (2) The fibres here have an upward course, and as far as they can be traced end freely, or perhaps in knots amongst the limiting line of cells of the cutis. (3) No anatomical distinction between the heat- and cold-points has as yet been found. (4) The temperature nerve fibres and the pressure fibres can be somewhat distinguished by the manner of their distribution and their relation to the capillaries. (5) There is no network of fibres, but each runs separately throughout its course.

These results, meagre as they are, nevertheless suggest some important considerations. One would expect to find terminal organs of some kind to serve for the reception of the dermal stimulus; this expectation is not realized. Their absence suggests that the explanation of the mode of action of the nerve fibres must be sought in their terminal distribution, that is, in the grouping of the endings. The physiological unit may be anatomically complex. At a pressure-point the skin possesses a number of nerve fibres which are spread out flat in the sub-epithelial cutical layer and by numerous branches supply a relatively large piece of dermal surface. The magnification of the surface supplied by the nerve fibre may serve to give discontinuous stimuli the effect of continuity, and thus serve the function of an end organ. At a temperature-point, a number of fine nerve fibres are crowded together in the immediate vicinity of blood-vessels. These fibres must be supposed sensitive to temperature changes; and, as before, a complex system of fibres serves as the end organ. If but one fibre supplied each point, it would take much more intense stimulation to produce sensation. Perhaps the happiest suggestion to which the absence of terminal cells leads Dr. Goldscheider is that the Meissner touch-corpuscles

are merely protective organs. These are found on such parts of the body (finger-tips, palms, sole) as are used for fine sensibility and yet are subject to violent pressure and injury. The corpuscle simply protects the nerve endings and thus allows a fine sensibility to be developed.

The time for writing the physiology of dermal sensations has not yet come, but the discoveries of Goldscheider and others give promise that the initial chapters of that book have been or are about to be written.

JASTROW.

PATHOLOGY.

Removal of a Large Sarcoma, Causing Hemianopsia, from the Occipital Lobe.¹ By W. R. BIRDSALL, and by ROBERT F. WEIR. (*Medical News*, April 16th, 1887.)

The following history, herewith reported conjointly by Dr. Weir and Dr. Birdsall, is that of a patient who during life presented left hemianopsia, optic neuritis, and certain disturbances in locomotion, from which the diagnosis of tumor of the right occipital lobe was made by several physicians, who also concurred in advising an operation attempting its removal, a fatal result appearing otherwise inevitable. As predicted, the tumor was found in the region described. It was removed in the manner to be stated by Dr. Weir, death resulting subsequently.

Male, æt. forty-two, a Hebrew, native of Poland, came under B.'s observation October 16th, 1886. Until the summer of 1885, he had always been healthy, and denied ever having had any form of venereal disease, or injury to the head. In August, 1885, after a sea-bath, he observed, for the first time, unsteadiness of gait, and had a severe attack of vomiting. Soon after diplopia for distance and increased awkwardness in walking were observed, and about the same time a disagreeable sensation, akin to numbness, in the right leg, hand, and shoulder, but not in the face. This and the diplopia were transitory. Headache, usually frontal, was present occasionally, but was never severe. Vertigo, or tendency in a definite direction, was not noticed at this time. No other sensory, motor, or visceral symptoms appeared. He was observed to miss articles when told to pick them up. This was probably due to the diplopia.

Oct. 7th, 1885. Dr. Seguin was the first to recognize in the patient the important localizing symptom, hemianopsia, and to make the correct diagnosis, and also to have seen him before and during the development of the optic neuritis, and at a recurrence of the diplopia.

"Examination: Eye muscles normal (no diplopia with red glass). Left pupil a trifle wider than right; both active; fundus normal. Has left lateral hemianopsia, vertical line passing a little

¹In view of the interest attached to this case, the report is reproduced almost verbatim and at more than ordinary length.—ED.